Geometry

Prerequisite: Algebra 1

The main goal of Geometry is for students to develop a Euclidean geometric structure and apply the resulting theorems and formulas to address meaningful problems. Students will use experimentation and inductive reasoning to construct geometric concepts, discover geometric relationships, and formulate conjectures. Students will employ deductive logic to prove theorems and justify conclusions. Students will extend their pre-existing experiences with algebra and geometry to trigonometry, coordinate geometry, and probability. Students will use dynamic geometry software, compass and straightedge, and other tools to investigate and explore mathematical ideas and relationships and develop multiple strategies for analyzing complex situations. Students will apply mathematical skills and make meaningful connections to life's experiences.

Standard I: Students will use algebraic and geometric ideas to understand trigonometry.

Objective 1: Use triangle relationships to solve problems.

a. Solve problems using the properties of special right triangles, e.g., 30°, 60°, 90° or 45°, 45°, 90°.
b. Identify the trigonometric relationships of sine, cosine, and tangent using right triangles.
c. Express trigonometric relationships using exact values and approximations.

Objective 2: Use the trigonometric ratios of sine, cosine, and tangent to represent and solve for missing parts of triangles.

a. Find the angle measure in degrees when given the trigonometric ratio.
b. Find the trigonometric ratio given the angle measure in degrees, using a calculator.
c. Find unknown measures of right triangles using sine, cosine, and tangent functions and their inverses.

Mathematical Language and Symbols Students Should Use
special right triangle, sine (sin), cosine (cos), tangent (tan), exact value

Standard II: Students will model and solve problems using spatial and logical reasoning and applications of geometric principles.

Objective 1: Use inductive and deductive reasoning to develop mathematical arguments.

a. Write conditional statements, converses, and inverses, and determine the truth value of these statements.
b. Formulate conjectures using inductive reasoning.
c. Prove a statement false by using a counterexample.

Objective 2: Analyze characteristics and properties of angles.

a. Use accepted geometric notation for lines, segments, rays, and angles.
b. Identify and determine relationships in adjacent, complementary, supplementary, or vertical angles and linear pairs.
c. Classify angle pairs formed by two lines and a transversal.
d. Prove relationships in angle pairs.
e. Prove lines parallel or perpendicular using slope or angle relationships.

Objective 3: Analyze characteristics and properties of triangles.

a. Prove congruency and similarity of triangles using postulates and theorems.
b. Prove the Pythagorean Theorem and its converse in multiple ways, and find missing sides of right triangles using the Pythagorean Theorem.
c. Apply triangle inequality theorems.
d. Identify medians, altitudes, and angle bisectors of a triangle, and the perpendicular bisectors of the sides of a triangle.

Objective 4: Analyze characteristics and properties of polygons and circles.

a. Use examples and counterexamples to classify subsets of quadrilaterals.
b. Prove properties of quadrilaterals using triangle congruence relationships, postulates, and theorems.
c. Derive and justify formulas for the number of diagonals, lines of symmetry, angle measures, perimeter, and area of regular polygons.
d. Solve problems involving radii, diameters, chords, secants, arcs, sectors, central angles, inscribed angles, and tangents of circles.
e. Prove and use relationships between the measures of intercepted arcs and inscribed or central angles.

Objective 5: Analyze characteristics and properties of three-dimensional figures.

a. Classify three-dimensional figures by their distinguishing characteristics.
b. Identify three-dimensional objects from different perspectives using nets, cross-sections, and two-dimensional views.

Mathematical Language and Symbols Students Should Use

conditional statement, converse, inverse, conjecture, inductive, deductive, counterexample, adjacent, complementary, supplementary, vertical, linear pair, transversal, congruent, postulate, theorem, median, altitude, angle bisector, secant, arc, sector, central angle, inscribed angle, tangent of a circle, intercepted arc, net, polyhedra, $\overline{AB}, \overrightarrow{AB}, \overleftrightarrow{AB}, //, \perp, \angle$

Standard III: Students will use coordinate geometry to explore geometric relationships and solve problems.

Objective 1: Describe spatial relationships using coordinate geometry.

a. Verify the classifications of geometric figures using coordinate geometry to find lengths and slopes.
b. Find the distance between two given points and find the coordinates of the midpoint.
c. Write an equation of a line perpendicular or parallel to a line through a given point.
d. Graph a circle given the equation in the form $(x-h)^2+(y-k)^2=r^2$, and write the equation when given the graph.
e. Determine whether points in a set are collinear.
f. Use translation, reflections, and rotations in the context of coordinate geometry.

Objective 2: Solve real-world problems using visualization and spatial reasoning.

a. Solve problems using the Pythagorean Theorem.
b. Solve problems using the distance formula.
c. Solve problems involving trigonometric ratios.
d. Solve problems using geometric properties.

Mathematical Language and Symbols Students Should Use
distance formula, equation of a circle, collinear

Standard IV: Students will use measurement tools, formulas, and techniques to explore geometric relationships and solve problems.

Objective 1: Perform basic geometric constructions, describing and justifying the procedures used.

a. Investigate geometric relationships using constructions.
b. Copy and bisect angles and segments.
c. Construct perpendicular and parallel lines.
d. Justify procedures used to construct geometric figures.
e. Discover and investigate conjectures about geometric properties using constructions.

Objective 2: Find measurements of plane and solid figures.

a. Find linear and angle measures in real-world situations using appropriate tools or technology.
b. Develop surface area and volume formulas for polyhedra, cones, and cylinders.
c. Determine perimeter, area, surface area, lateral area, and volume for prisms, cylinders, pyramids, cones, and spheres when given the formulas.
d. Calculate or estimate the area of an irregular region.
e. Find the length of an arc and the area of a sector when given the angle measure and radius.